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## The Emerging U.S. System of Systems

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### Conclusions

The things which give military forces the fighting capability changing and these changes point toward a qualitative jump in our ability to use military force effectively.

Probably relating to the way we plan a program and get things done are more adept at seeing the individualities than that a staff for systems military capability (the system of systems) which the individual systems are building for our fighting forces.

The system of systems depends ultimately on well worded standards and distributions of all the military services. This assumes a common appreciation of what they are building. Most importantly, it requires joint strategic and operational doctrine by which to organize, plan, and carry out military operations.

### Revolutions in US Military Toward Fundamental Change

Three simultaneous revolutions are propelling the US military toward fundamental change. The first is the implosion of the Soviet Union, the end of the Cold War, emergence of the United States as the sole military superpower. We are also experiencing a revolution in the reallocation of resources from defense to domestic programs, which began in the decade and a half preceding the demise of the Soviet Union. The third is what some call the revolution in military affairs (RIMA). RIMA began because of earlier investments, particularly in electronic and computational technologies, in things which give military forces their fighting capability. It is a leap forward toward a qualitative jump in our ability to use military force effectively. This RIMA achievement enables us to take full advantage of the opportunities presented by the first two revolutions, without compromising organizational security or position as a world leader.

What kind of change are emerging as a result of the American RIMA? They fall into three general categories, which for convenience, we may call intelligence, command and control, and precision force:

**Intelligence, surveillance, and reconnaissance (ISR).** It involves sensor and reporting technologies associated with intelligence collection, surveillance, and reconnaissance, as well as new means by

which we are able to keep track of what our own forces are doing going.

**Advanced C4I-command, control, communications, computer applications and intelligence processing - the chain in which we convert the sensorware we do to an understanding of a battle space and convert that understanding to missions and assignments designed to alter, control, and dominate that battle space.**

**Precision force** A broad concept in which the knowledge and orders generated from the first two areas are translated into action and results.

It is easy to miss the powerful synergy which exists between SR, ISR and precision force. Look at table 1, a cross section of some of the weapon and systems in use or soon to be available to our fighting men and women. We need to plan, program and budget for these things as if they were discrete discrete capabilities. We are more adept seeing the individual strengths than a forest of military capability which the individual system because of their interactions build for our fighting forces. Fortunately, when you go to see in the field, the things actually happening you can see early signs of how it will fit together. From this you can envision how future systems in the hands of well-educated and trained officers, sailors, marines and airmen portend a qualitative and quantitatively different military for the country.

Table 1  
Weapons and Systems for Enterprising  
U.S. Military in the Future

ISR (sensors)	C4I	Precision Force
MWICSS	GCOSS	SFW
RIMB RQINTINT	MILSATCOM	JSCOM
EP-3EE	JS1PS	TIAW/BLR (III) (II)
JSTARS	DISSIN	ATACOM/BABAT
HASSA	JUDI	SILAWN
SIRR	C4I FTRW	CAUCOM
TIER R2 & +	TADLUJ J	HAVE NAP P
TIER R3-3	TRAMP	AGM130 D
TARPS	TAC SAT	HARM
MTI	JWIDSS	AIR HAWK K
REM BASS	MIDS	SACOFMM
MAGCIC	SONNET	HEILEIRER II
LANTERN		

The growing capacity to infuse DBK into all our forces will be coupled with the real time awareness of the situation and the understanding and what they can do with their growing capacity to apply force with speed, accuracy and precision. This means we will increasingly make the right force to the most surprising course of action at both the tactical and operational levels of warfare. Furthermore we will have increasing capacity to apply tailored forces faster, with more precise weapons and over greater distances. The enhancements in ISR and ISR will allow us to know the effects of our actions and understand what the effectiveness with far more fidelity, far earlier than anything we have experienced to date. This will give force great fighting advantage. This battle assessment, in turn, will have subsequent actions more effective. As a result, we truly will be able to operate within the opponents decision cycle. This is a system of systems capability, combined with joint doctrine designed to take full advantage of these new fighting capabilities, is the heart of the RMA. It emphasizes a joint perspective, because the systems of systems depends primarily on the well-orchestrated combination of all the military services. This requires common appreciation of what we are building and, more importantly, requires common strategic and operational doctrine by which to plan and carry out military operations.

The RMA is inevitable. But the speed at which it comes depends on willingness to embrace these

changes in our policy, planning and programming decisions. By accelerating the transition, we could actualize the RMA perhaps decades before anyone else from this. This is important for many reasons; one of the most significant is that it will ensure ability to protect ourselves while enhancing our ability to shape the international environment, rather than simply reacting to it.

This, then, is the essence of the argument in favor of accelerating the RMA: a bold vision and a controversial one. Vision is crucial, they have what motivates forward and provides the means to deal with an unknown future. However, the profession of military should unify this vision unless it holds up to honest critique. Let us examine the five most thoughtful criticisms that have been raised.

### **Opponents Fight Back**

The conflicts we face will remain competitive among thinking, learning, and adaptive human beings. We need to recognize that any future opponent will do likewise and intelligently try to counter capabilities the system of systems gives us.

History is replete with examples of how advanced military technology were eventually countered or matched. Yet history also has intriguing examples of real revolutions in military affairs—Guderian's blitzkrieg, Hitler's vision of amphibious warfare, and the early evolution of naval power. None of these provided dominance in all areas of military operations; and, the edge they enjoyed quickly eroded. But it was good to have the edge—not only because it paid off in conflict, but also because it gave leverage when implementing foreign policy.

I believe the inherent character of the system of systems provides an edge in the competition of conflict. The technology it fosters emphasizes flexibility and adaptability. It will enable the U.S. military to know more about the flow of conflict than an opponent can put together within the decision cycle of that opponent. It will allow American forces with the means to learn faster on a battlefield (traditional or otherwise) and allow them to be more adaptable and flexible than an opponent either would. In other words, the coming RMA starts from the fundamental assumption shared by its critics: war is a human contest that rewards innovation, learning, adaptability, and flexibility.

### **Relying on Technology is a Achilles Heel**

Reliance on "information" technologies—the kind of sensors, data processing and communications subsystems that appear in table-top games like Risk—is inherently vulnerable if its own technologies to offensive information warfare, or "hacking."

There is, to be sure, a danger in relying on military systems that have exploitable flaws. Indeed, the characteristic that gives any system its potency—that the parts of a system enhance the effectiveness of one another—also makes it more susceptible to catastrophic failure if one of the central parts can be corrupted. Yet there are some aspects of the system of systems that ought to alleviate, if not refute, these concerns.

First, the people implementing the vision are framing right out of the get-go of inherent flaws! A great deal of thought, planning, money and effort goes into reducing real or hypothetical vulnerability. We won't wait until someone else finds a vulnerability; we will think hard and work continually to find and eliminate it first.

Second, the computer and communication technologies on which the systems of systems are based are

becoming less, not more, susceptible to the various forms of corruption and interference. A race will always exist between those who try to ensure the security of information-based systems and those who seek to overcome their security measures. Yet, the trend favors the defense. In part, this is because of the relative "hardness" of the new generations of communications equipment. Fiber optic cable, for example, has physical characteristics that make it inherently more difficult to "tap" surreptitiously.

Third, there is a robust redundancy to the emerging American system-of-systems. This redundancy works against the possibility of breaking the whole system. It also means that if there are ways of successfully attacking parts of the system, the overall system would not collapse but rather generate "work arounds" or gracefully degrade. In one sense, this is faint praise; we don't want the system-of-systems to degrade at all. In another, it suggests that an opponent would be impotent before he could defend against, counter, or defeat the capabilities we use against him.

Clearly, none of this is cause for complacency; we need to continually bear in mind potential vulnerabilities and work hard to find and end them. Neither can a compelling case be made that the vision is flawed logically or that moving to the system-of-systems carries more practical risk than sticking with the *status quo* and traditional way of doing things.

### **It Applies Only to the Last War**

Some argue that the system-of-systems may work only in a conflict similar to Desert Storm, with relatively open terrain, an inept opponent, and enough time to amass an overwhelming force. Future conflicts may take place in terrain less open, against a motivated force astutely led. Urban areas, jungles, and mountains are as likely to be future battlefields as open deserts. Under these circumstances, it is argued, the system-of-systems is less applicable, and relying on it in place of a more "traditional" force is unnecessarily risky.

However, the system-of-systems applies *across* the full spectrum of conflict. It promises a better, although different, way of doing things. Americans will always seek to use military force with speed, precision, effectiveness and minimal risk to our personnel. The dispositions, movements, and capabilities of an opponent's forces may be easier to discern in open desert than in downtown Mogadishu or triple-canopied jungles. But this is no reason to refrain from trying to discern enemy characteristics. The fact is that the system-of-systems will give us far better capacity to do this, and with greater effectiveness and lower risk than we currently have. Furthermore, it is obvious that it would be highly advantageous to the nation if we found alternatives to the large manpower base and force structure which was the hallmark of our military forces during the Cold War. The system-of-systems and RMA holds out the promise that in the not too distant future the pointed end of the spear may be smaller, far sharper and able to pierce the opponents jugular vein on the first throw.

### **The System-of-Systems Reduces the Fog and Friction of War**

Conflict is chaotic, confusing, and messy. We will never have *perfect* understanding of a battlefield, our systems and weapons will never work flawlessly *all the time*, and the forces we ask to wage war will never do everything correctly *every time*.

The system-of-systems does not offer omniscience or omnipotence. It has demonstrated the ability to reduce the fog and friction of war and promises to do even more so in the future. What counts in war is the relative influence on the opposing side of what some have called the fog and friction of conflict. The side that can reduce the effect of that fog and friction significantly, relative to its opponent, will win.

## **It's Not Broken, Don't Fix It**

There is considerable agreement within the Department of Defense and elsewhere on the central issues of issues: that we ought to continue to develop our capacity to understand the battle spaces in which we may operate, to improve joint operations, and continue to explore new technologies. The real issue is the rate at which we should move and which funding levels and force structures to favor.

The amount of money needed to accelerate the achievement of the vision is not substantial; most of the programs that drive the R&I MRA are already funded. The real problem is relative priority, and not all of them should necessarily be accelerated. The significance is, after a sufficient number of interactions, Accelerating some of them may give only marginal gains. Some simply can't come any faster no matter how much money and manpower we devote to them.

At the center of the debate is whether we should shift resources from some programs and the forces associated with them and give it to others. Making that decision is not the issue. What is the rationale used for making them in the past? We used the perception of the threat to get us developed new capabilities to keep ahead of our peer competitor; the Soviet Union. No one realized that things inside the military were broken and had to fix it in the Department through a period of introspection after Vietnam.

Now, however, neither of these rationales is particularly valid. There is no peer competitor and we won the last war. So the Ocean's razor has changed. Today's rationale is maintaining an adequate defense today while building a priority for the 21st century; (2) what the American people will support and the economy can sustain over the long haul.

The system-of-systems is emerging as the result of the creation of the Internet. Increasingly, a big and dangerous world where coalitions will parallel and perhaps replace alliances and nations will look to look for U.S. leadership. The smart, flexible, mobile, effective force system-of-systems will make sense.

## **Recommendations**

The R&I MRA is inevitable. But the speed at which it adapts to the needs depends on recognition of what is emerging and a willingness to embrace the changes in policy, planning and programming decisions. By accelerating the transition, one would actualize the R&I MRA before any other nation.

The amount of money needed to accelerate introduction of the system-of-systems is not substantial; most of the programs that drive it are already funded. The core of the debate is whether we should shift resources from some programs and the forces associated with them and increase others. Tradeoffs are nothing new. What is new is the rationale used for making them. The Ocean's razor defense has changed. Today's rationale is (1) maintaining a quite defense today while building superiority for the 21st century; (2) what the American people will support and the economy can sustain over the long haul.

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